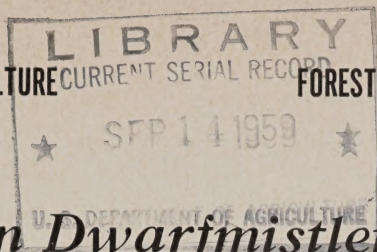


Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

A42319
F 764
cop 2

U.S. DEPARTMENT OF AGRICULTURE
Forest Service



FOREST PEST LEAFLET 40
September 1959

Western Dwarfmistletoe on Ponderosa Pine

By James W. Kimmey and James L. Mielke, forest pathologists, Intermountain
Forest and Range Experiment Station

The typical form of the western dwarfmistletoe (*Arceuthobium campylopodum* forma *campylopodum* (Engelm.) Gill) is a common parasite of ponderosa and various other hard pines. It occurs on ponderosa pine in California, Nevada, Oregon, Washington, Idaho, and Montana. Its range also extends into British Columbia, Canada, and Lower California, Mexico. The western dwarfmistletoe is distinct from the southwestern dwarfmistletoe, *A. vaginatum* (Willd.) Presl., which also occurs on ponderosa pine, but is limited in its range on that host to Utah, Colorado, New Mexico, Arizona, and the mainland of Mexico. Southwestern dwarfmistletoe is the subject of Forest Pest Leaflet 19.

Host Trees

The common natural hosts of this form of western dwarfmistletoe are Coulter, Digger, Jeffrey, Monterey, ponderosa, and knobcone pines. It occurs commonly on all of these pine species, but is most widespread on ponderosa pine. Rarely, conifers of a few other species are infected when growing intermixed in heavily infected stands of these common hosts. Six other forms of this

dwarfmistletoe species occur on various western conifers.

The Parasite

Dwarfmistletoes are parasitic seed-bearing plants. They occur on branches or stems of their host trees, where they are attached with a modified root or absorbing system inside the host tissues. The male and female flowers are produced on separate plants (figs. 1 and 2), but both may occur on a single tree branch at separate infection locations.

Aerial parts appear as perennial, simple or branched shoots, usually occurring in fanlike tufts. The shoots are 3 to 5, rarely 8, inches long, jointed, four sided, and have minute scalelike leaves. Female plants are olive green, and male plants yellowish in color. The small inconspicuous flowers bloom in August or September, and the greenish colored berries, which contain a single seed (fig. 2), mature the second autumn after pollination. Male shoots die after flowering, and female shoots die after the seeds have been discharged. The dead shoots then drop, leaving basal "cups" (fig. 3, 4).



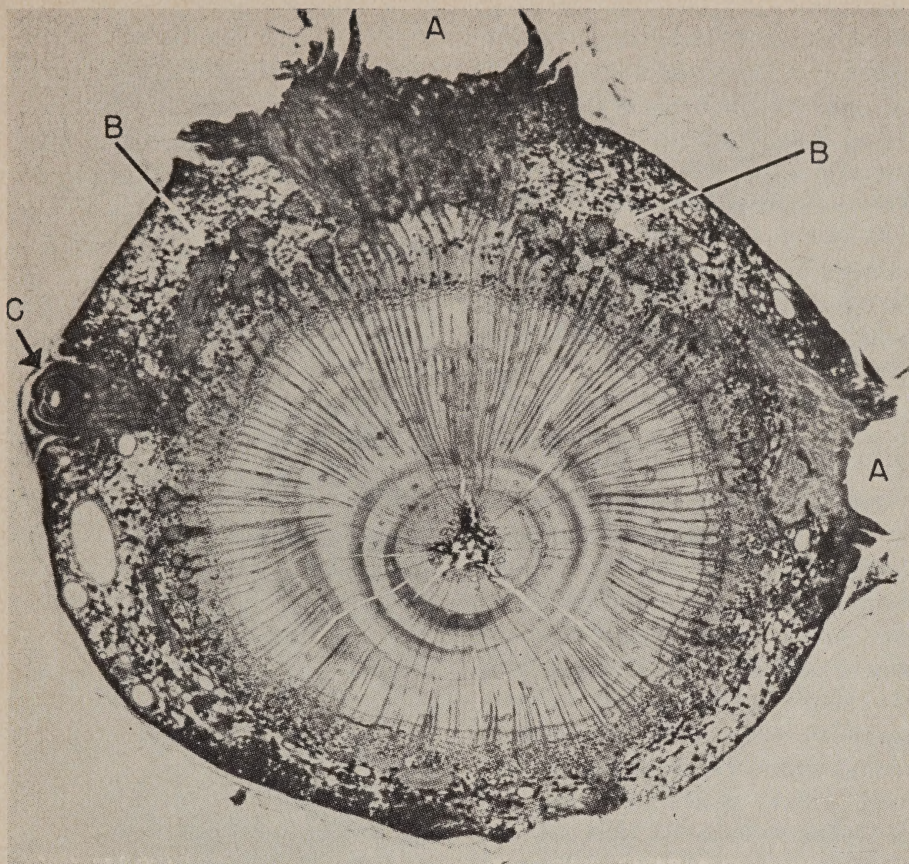
FIGURE 1.—Typical young male plant of western dwarfmistletoe on a pine branch.

Life cycle of the parasite from host infection to the first crop of fruits normally requires not more than 5 to 6 years. The seeds are

forcibly discharged when reaching maturity in the autumn. They are held fast to any surface on which they alight by a mucilaginous sub-



FIGURE 2.—Female plant of western dwarfmistletoe producing berries. Pine branch shows typical spindle-shaped swelling.



F-489326

FIGURE 3.—Enlarged cross section of a pine branch infected with dwarfmistletoe. *A*, Basal “cups” from which aerial parts of the parasite have dropped. *B*, Rootlike strand masses in the bark from which dark, wedge-shaped sinkers originate and extend into the wood. *C*, A new dwarfmistletoe bud breaking through the surface of the host bark.

stance surrounding them. Most seeds do not germinate until the following spring and if attached to 1- to 3-year-old twig growth of a pine may establish a new infection. Penetration of the pine bark by the primary root (radicle) is seldom possible on older and thicker bark. Once the radicle is inside, threadlike strands branch off and ramify in the bark, penetrating to the cambium. The parasite cannot penetrate wood tissue, but the strands become im-

bedded by the wood growing about them (fig. 3, *B*). Aerial shoots arise from buds produced by the strand masses in the pine bark (fig. 3, *C*).

Method and Rate of Spread

The method of spread of dwarfmistletoe is through the forcible discharge of its seed. On ripening, the berries develop an internal pressure, which causes them to ex-

plode and eject the single seed upward and outward with considerable force. The maximum horizontal distance the seeds may be projected is approximately 30 feet, but the average distance is much less. The seeds are so heavy that they are not carried by the wind. Birds and animals are not considered significant in the spread of this parasite because they eat dwarfmistletoe seeds only occasionally.

The rate of spread of western dwarfmistletoe through ponderosa pine stands is slow. Maximum spread and damage occur in partial burns or logged areas where scattered remaining overstory trees shower seeds on surrounding reproduction. The maximum distance of spread that occurred over a period of about 60 years from mature overstory trees into surrounding reproduction was found to be 130 feet. Heavy infections were concentrated within 33 feet of the overstory infection source. Beyond 33 feet, infections were moderate to light. Rate of spread of the parasite is slower through single-storied stands.

Symptoms of Infection

Plants of dwarfmistletoe in a tree are the best early and certain indication of host infection.

Swellings that develop in the bark on infected twigs and branches where the parasite shoots are attached (figs. 1 and 2) may later become roughened and cankerlike.

Witches'-brooms, which are distorted and proliferous growths of branches (fig. 4), are associated

with extensive development of the parasite in the host tissues.

Trunk cankers (fig. 5) sometimes develop where infection in the trunk is of long standing. Often these cankers are burned out by forest fires, because they are pitch soaked and are readily ignited by the highly flammable brooms usually associated with them.



F-489327

FIGURE 4.—Witches'-brooms, caused by western dwarfmistletoe, partially killing and completely deforming the crown of a ponderosa pine.



F-489328

FIGURE 5.—Large trunk canker caused by a long-standing infection of western dwarfmistletoe in the trunk of an old-growth ponderosa pine. Fire has enlarged the canker area by burning resin-soaked wood.

Reduced thrift and sparseness of foliage, except in broomed portions of the crown, often indicate dwarfmistletoe infection.

Lightly infected stands are not readily distinguished from healthy stands except by the presence of the dwarfmistletoe plants, and such symptoms as branch swelling and cankers, or small witches'-brooms. Heavily infected stands, on the other hand, appear to have devel-

oped under poor site conditions. They generally contain badly broomed, deformed, stunted, dying, and dead trees.

Damage

Western dwarfmistletoe causes more damage to ponderosa pine than any other disease. The parasite diverts food and water for its own growth and for the particular branch that supports it. Trees of any age may be retarded, deformed, or killed.

Mortality is especially heavy in sapling and small pole stands, and some young stands may be so heavily infected as to be practically worthless.

Growth reduction of tree diameter and height constitutes the greatest loss caused by this disease. Annual increment in heavily infected stands may be practically nil. Even in lightly infected stands growth may be significantly reduced.

Quality reduction of merchantable timber results from dwarfmistletoe infection. Quality is reduced by numerous large knots and by abnormally grained, spongy wood that is frequently pitchy and often stained and decayed by fungi that enter open cankers.

Seed reduction is a serious type of damage, especially in heavily infected stands where the seed crop may be drastically reduced. Quality of the seed is also lowered. Seed from infected trees has a lower germination percentage and produces less vigorous seedlings than seed from uninfected pines.

Control

Eradication is the underlying principle upon which satisfactory control of dwarfmistletoe is based. It may be approached by cutting or otherwise killing the infected trees. However, it is often desirable and economically feasible to prune out branch infections that have not yet grown into the main bole of young trees. If the distance from the swelling (or other indication of infection) to the base of the branch is 4 inches or more, the infection may be eliminated by cutting off the branch flush with the tree bole. Bole infections cannot be satisfactorily cut out; therefore, trees thus affected must usually be removed. Since light stimulates the growth and activity of dwarfmistletoe, the opening of a stand, through partial cutting or control activities, may increase dwarfmistletoe damage, rather than reduce it, if many infections are left in the residual stand.

In recreational areas and on administrative sites where control with a minimum of tree removal is desired, values may be sufficiently high to warrant pruning older trees. Since only actively growing female dwarfmistletoe plants produce seed, they are the only ones that need be removed to prevent spread of the disease. All plants, however, are equally able to damage the pines; therefore it is desirable to remove large living brooms to restore tree vigor even though no active female plants are present. A followup cleaning to remove missed or latent infections should be con-

ducted after about 3 years. In some areas two or three periodic cleanups may be necessary.

In commercial stands of ponderosa pine, control is most economically effected by silvicultural practices. The parasite usually occurs in patches with heavy infection concentrated on areas of only a few acres. The first step in control procedure should be to delineate these concentrations. Clear cutting in such areas is usually the best practice for effecting control. Control unit boundaries should not be located through infected stands.

After a control area has been delineated on the ground, the next step should be to remove the overhead source of infection. Infected trees of saw-log size should be logged unless it is desirable to retain some pines from which the infections can be removed by pruning.

After the overstory has been cleaned, dwarfmistletoe infections in the understory should be removed, either by cutting or by a combination of cutting and pruning infected trees.

Three years after the first operation the area should be carefully reworked to remove the dwarfmistletoe plants that have subsequently appeared. After that, examinations should be made at about 5-year intervals to detect new infections. The number of new infections appearing, the rotation age on which the stand is being managed, and other silvicultural and economic factors will dictate if and when further cleanup operations are required.

In extremely heavily infected areas, clear cutting followed by broadcast burning may be the most practical means of controlling the disease. In large areas so treated, planting may be required.

References

- DWARFMISTLETOE OF PONDEROSA PINE IN THE SOUTHWEST. STUART R. ANDREWS. U.S. Dept. Agr., Forest Serv., Forest Pest Leaflet 19, 4 pp., illus. 1957.
- FOREST PATHOLOGY. J. S. BOYCE. Ed. 2, 550 pp., illus. McGraw-Hill Book Co., New York. 1948.
- ARCEUTHOBIMUM IN THE UNITED STATES. L. S. GILL. Conn. Acad. Arts and Sci. Trans. 32:111-245, illus. 1935.
- DWARFMISTLETOES OF CALIFORNIA AND THEIR CONTROL. J. W. KIMMEY. U.S. Forest Serv. California Forest and Range Expt. Sta. Tech. Paper 19, 12 pp., illus. 1957.
- PINE DWARFMISTLETOE ON THE PRINGLE FALLS EXPERIMENTAL FOREST. L. F. ROTH. U.S. Forest Serv. Pacific Northwest Forest and Range Expt. Sta. Research Note 91, 3 pp. 1953.
- EXTENT OF THE ENDOPHYTIC SYSTEM OF DWARFMISTLETOE ON PINUS PONDEROSA. K. R. SHEA. Phytopath. 47:534. [Abstract.] 1957.

